

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Wai Ming Choi

Application No.: 10/822,440

Filed: April 12, 2004

Entitled: LOW DENSITY NONWOVEN GLASS  
FIBER WEB

Docket No.: 72545-83

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March 7, 2007

Date of Signature and Mail Deposit

By: 

Lisa Adams, Reg. No: 44,238, Attorney for Applicant(s)

Commissioner for Patents  
P.O. Box 1450  
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**1.132 Declaration of Wai Ming Choi**

I, Wai Ming Choi, residing at 1569 Commonwealth Ave, West Newton, Massachusetts, hereby declare as follows:

1. I am a Chief Scientist at Hollingsworth & Vose Company, and my responsibilities include high efficiency glass fiber media development. I have been working at Hollingsworth & Vose Company for 14 years and I have been developing glass filter media grades for over 10 years.
2. I obtained a Master of Science degree in Chemical Engineering.
3. I have read the above-referenced application, and I fully understand the materials disclosed and claimed therein.
4. The above-referenced patent application is directed to a nonwoven filter media

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formed from glass wool fibers having a gamma value of at least about 14.

5. In the course of the research that resulted in the invention described and claimed in the above-referenced patent application, I set out to develop a glass filter media having a high gamma value. I prepared filter media using glass wool fibers, however when tested these filter media had gamma values of about 12-13. I unexpectedly discovered that adjusting the pH from an acidic pH to a neutral pH during formation of the filter media resulted in a filter media having a gamma value of at least about 14. In particular, the pH is adjusted by first adding an acidic agent to a slurry containing glass wool fibers, since glass wool fibers are anionic by nature. The acidic pH is then adjusted by adding a neutral or alkaline pH adjusting agent to the slurry to bring the pH to a range of about 6 to 12. I discovered that this additional step of adding a neutral or alkaline pH adjusting agent to the slurry unexpectedly produces a nonwoven glass web having improved filtration properties, and in particular having a gamma value of at least about 14.

6. Example 1 of the pending application illustrates the effects of adjusting the pH during formation of the filter media. As explained in paragraph [0034] of the pending application, a slurry was prepared containing a mixture of glass fibers, and the pH of the slurry was adjusted to a range of about 2.3 to 3.8. Three samples of fiber web were collected at a pH of 2.3, 3.6, and 3.8. The experiment was repeated containing the same fiber mixture, however the pH was adjusted to a range of between 4.3 and 10.3. Samples were collected at pH's ranging from 4.2 up to 10.4. The results are set forth in Table 1 of the specification. As shown, the samples collected at an acidic pH (i.e., samples 2.3, 3.6, 3.8, and 4.2) that was *not adjusted* have a gamma value of about 13. Conversely, the samples collected at a neutral pH (i.e., 6.7, 7.0, 8.0, 8.4, 9.2, 9.6, and 10.4) that was adjusted from an initial acidic pH have a gamma value that is 14 or greater. Thus, adjusting the pH of the slurry from an acidic pH to a neutral pH clearly improves the gamma value of the resulting filter media. Table I also shows a significant improvement in the apparent density and the surface area of the filter media as a direct result of adjusting the pH of the slurry.

7. The following Example A further proves that a gamma value of at least about 14 can only be obtained by adjusting the pH of the slurry first to an acidic pH, and then to a neutral

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or alkaline pH.

### Example A

A slurry was prepared containing 50 lbs. of Evanite 706X fiber having an average fiber diameter of about 0.69 $\mu$ , 30 lbs. of Evanite 312X<sup>1</sup> fiber having an average fiber diameter of about 4.2 $\mu$ , 3 lbs. of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.25 inches, and 3 lbs. of Owens-Corning Chopped Glass fiber DE having an average fiber length of about 0.5 inches. The slurry contained water and sulfuric acid sufficient to yield a fiber concentration of 0.75% by weight. Samples were collected and the properties of each sample were tested and are shown in the chart below. All tests were conducted at an air velocity of 5.33 cm/sec with a DOP particle size of 0.3 microns.

DOP (%)	Resistance (mm H <sub>2</sub> O)	Ream Weight lbs	Caliper (mm@ 5Kpa)	Surface Area (sq m/g)	Gamma (100P)	pH Corning Model 430	pH indicator paper colorpHast 2.0-9.0
0.0024	35.9	47.08	0.453	n/a	12.87	5.67	5.5
0.0012	36.0	46.45	0.474	1.816	13.67	n/a	n/a
0.0017	35.6	46.06	0.458	n/a	13.40	n/a	n/a
0.0026	35.5	46.29	n/a	n/a	12.92	n/a	n/a
0.0013	36.0	n/a	n/a	n/a	13.57	n/a	n/a
0.0006	39.0	49.85	0.487	1.8101	13.39	5.73	5.0
0.0008	39.8	50.01	0.487	n/a	12.81	n/a	n/a
0.0021	39.5	50.40	0.482	n/a	11.84	n/a	n/a
0.0019	40.0	49.30	n/a	n/a	11.80	n/a	n/a
0.0014	37.4	47.16	0.464	n/a	12.98	5.55	5.5
0.0014	37.6	47.32	0.462	n/a	12.91	n/a	n/a
0.0021	36.9	47.32	0.458	n/a	12.68	n/a	n/a
0.0021	37.5	47.01	n/a	n/a	12.47	n/a	n/a

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<sup>1</sup> Applicant notes that Evanite 712X used in Applicant's original experiments is no longer available, but is substantially identical to Evanite 312X. Evanite 712X had an average fiber diameter of 4.2 microns, whereas Evanite 312X has an average fiber diameter of 3.9 microns. This difference is insubstantial and does not affect the outcome of the test results.

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As shown, all samples have a Gamma in the range of about 11 to 13. When compared to Example 1 in the pending application, the above Example A illustrates that adjusting the pH of the slurry during formation of a glass wool fiber web is directly responsible for producing a filter media having a gamma value of at least about 14.

8. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: 3/7/2007

  
Wai Ming Choi

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